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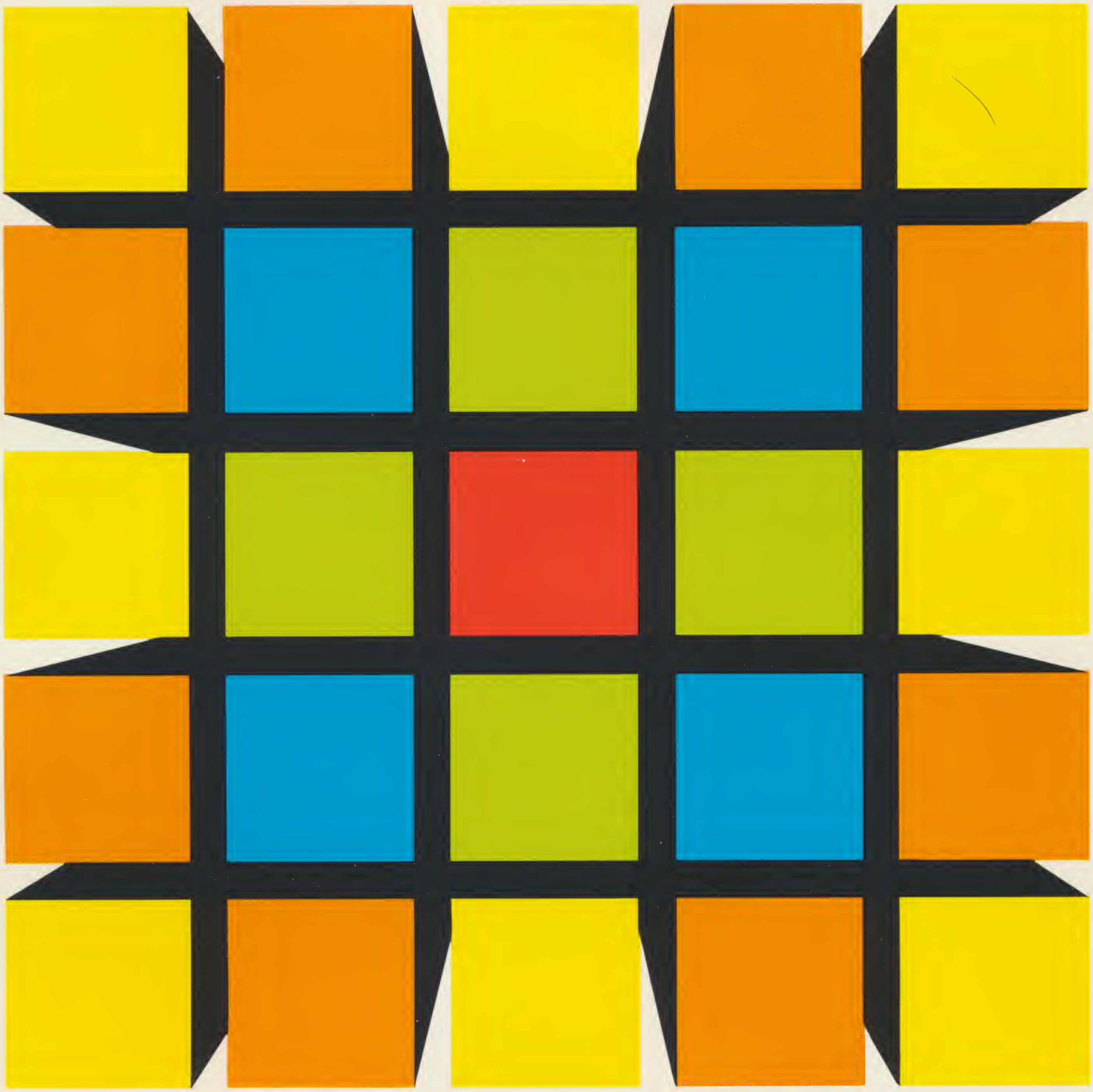
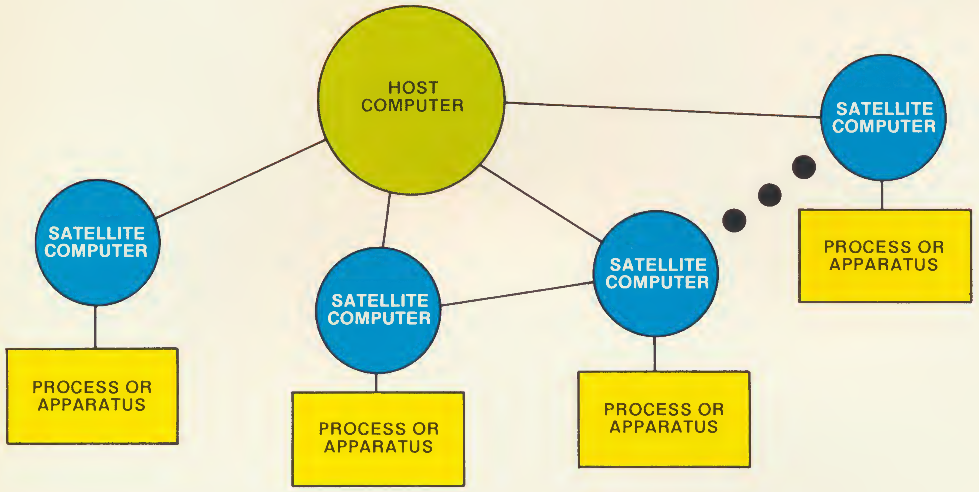
MAXNET

The Software Operating System for Distributed Computing Networks



MODCOMP

Why a MAXNET distributed computing system?



Centralized monitoring and control
A MAXNET system, consisting of MODCOMP computers connected together by means of communications lines, enables all operations within a widespread facility or company to be monitored and controlled from a central host computer.

Centralized storage, processing and display
The programs required to perform all system functions and the data gathered in real time at all system nodes can be stored, displayed, or processed at one centralized host computer site.

Global peripheral device sharing
The disc files, line printers, magnetic tape drives and other peripherals connected to the large computers in the network can be used by all other computers, since MAXNET can relay peripheral device Read or Write requests.

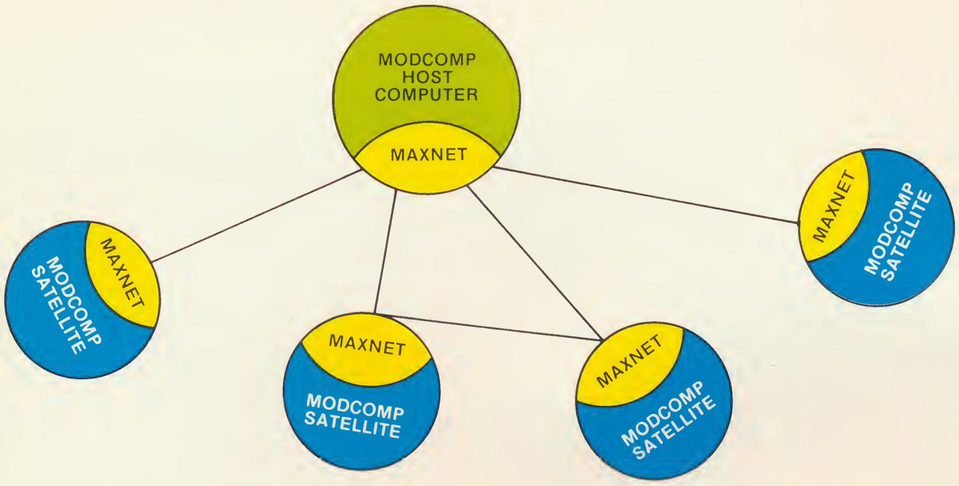
Operators not needed at satellites
A trained computer operator is not needed even to load the programs initially or restart the computer after a power interruption at remote sites. All of these functions can be performed from the host computer.

Simultaneous execution provides fast local response
Satellites can be dedicated to performing local tasks. Only low priority functions such as summary data display and report generation need be sent on to the host computer.

System economy
A network of small computers sharing resources costs less than either one large computer or an equal number of independent small computers having redundant resources.

System reliability
The temporary loss of one computer does not stop the rest of the network, and redundant computers can be added for even greater reliability.

What is MAXNET?



MAXNET is a software operating system which

Resides in each network computer
A MAXNET system can be tailored through standard SYSGEN procedures to meet the requirements of each network computer.

Handles all communications between computers
All line protocol, error checking and retries are handled by MAXNET.

Provides downline program loading from host to satellites
Satellites can be equipped with automatic fill hardware which is controlled remotely by the host computer.

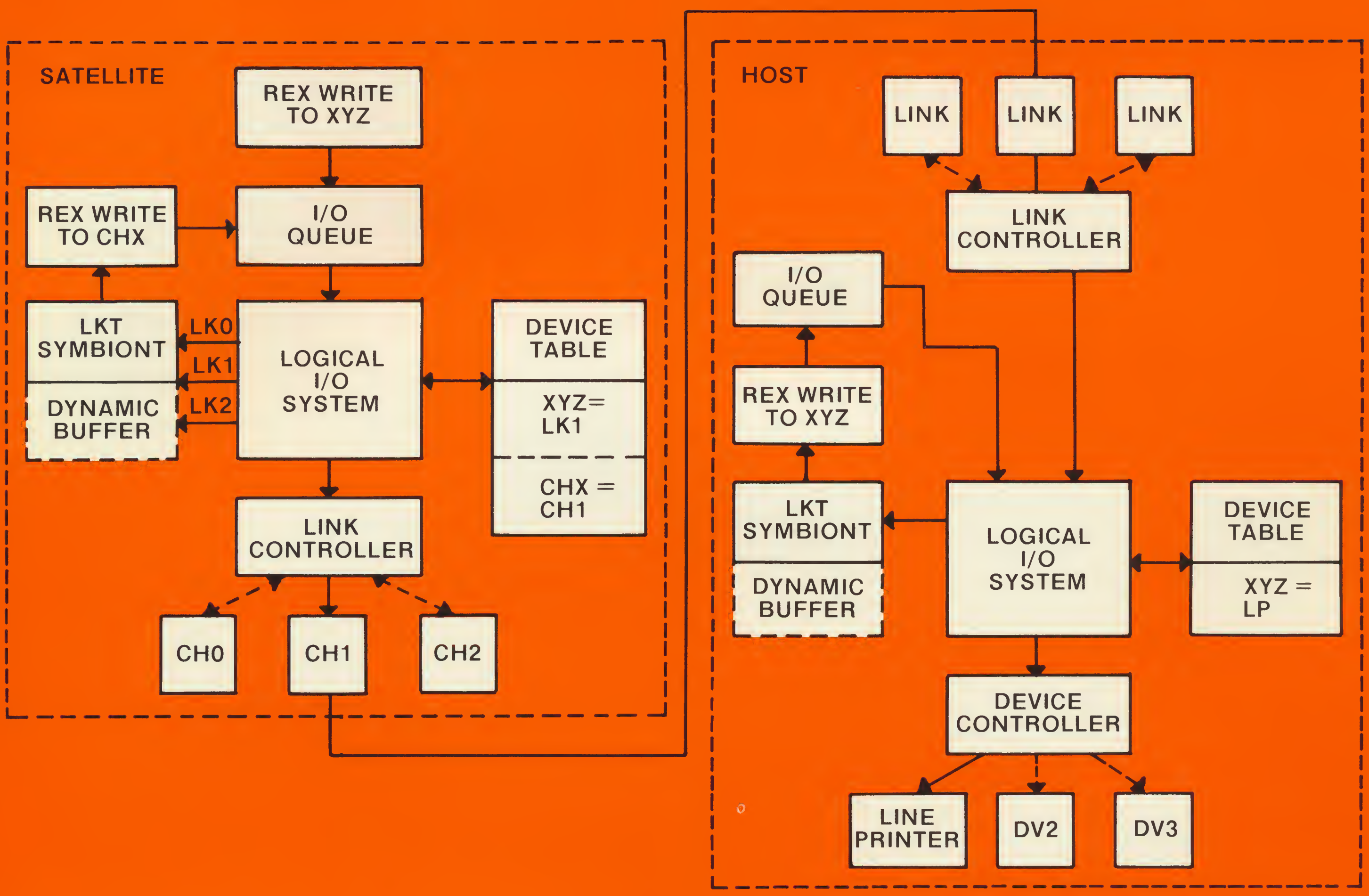
Enables each computer to control tasks in others
The task control commands include: Activate, Kill, Hold, Resume, Assign, Establish, and Deestablish.

Permits programs to use local or remote peripherals
Programs written with logical file I/O assignments can have the files assigned to either local peripherals or remote peripherals at run time.

Makes all services available in higher level languages
FORTRAN READ and WRITE statements, assembly languages Calls and operator directives are provided as the user interface to all control and communication services.

Makes other MODCOMP software available
MAXNET is a superset of MAX III and MAX IV. All of the local multiprogramming and user services of these advanced systems are available to the MAXNET user, as are the MODCOMP FORTRAN compiler, assembler, file manager and utility software.

How does MAXNET work?



Remote print example:

Writing a logical file XYZ is initiated by requesting an executive write service (REX WRITE).

After the prioritized I/O queue is cleared, the logical I/O system is entered.

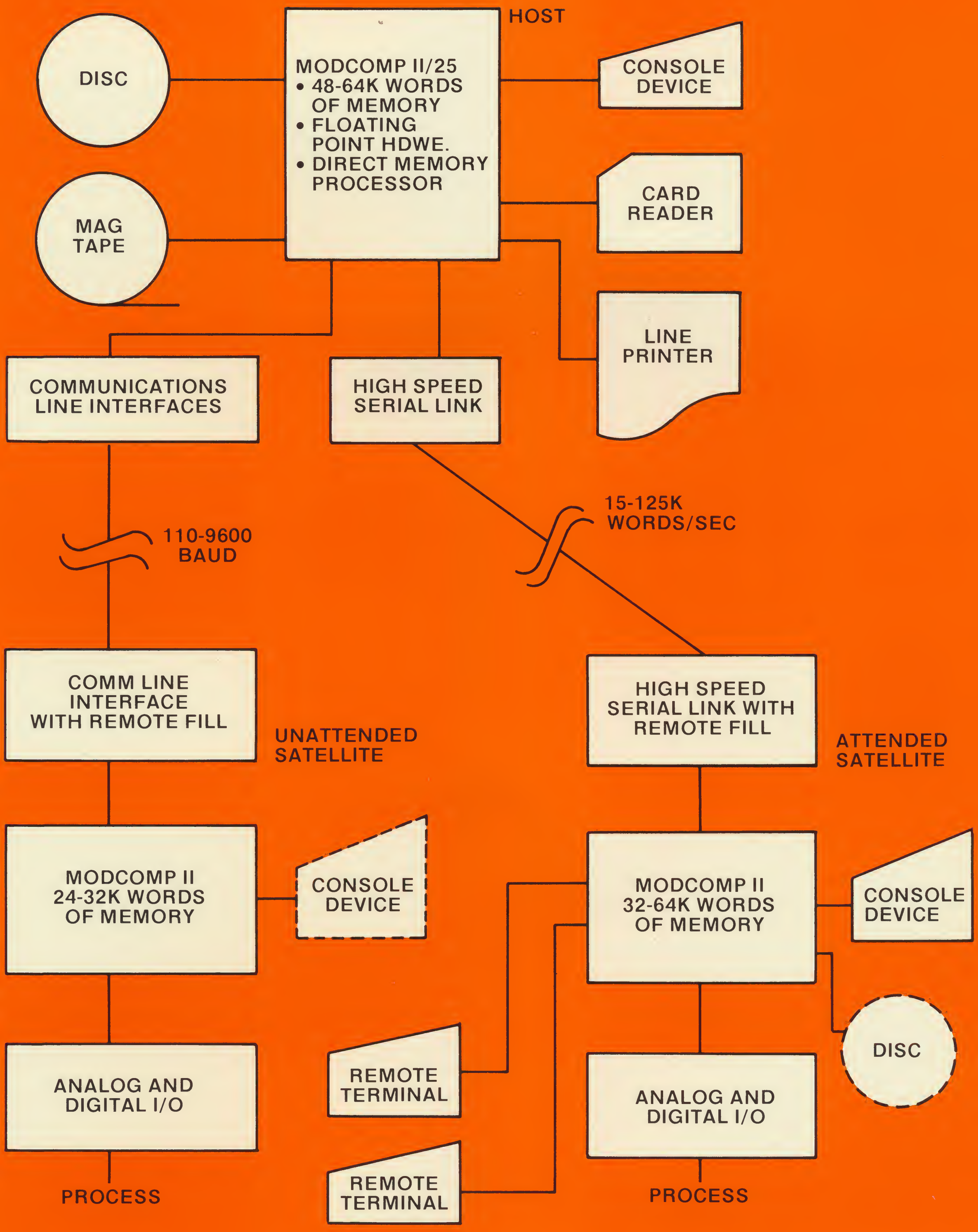
The device named LK1 is found, causing the link symbiont to be entered.

LKT allocates a dynamic buffer, stores the data to be printed, clears the write to XYZ, and requests a write to CHX.

The logical I/O system is again entered, CHX = CH1 is found, causing the link controller to be entered.

The link controller transfers the data and control information to its counterpart on the other end of the link, handling protocol and error checking.

The reverse process is performed in the host, causing the data to be printed.



Typical MODCOMP II/MAXNET host and satellite configurations

MAXNET host functions.

Compilation, assembly, and debugging of programs for all network computers

Programs can be developed in the host or other larger network computers and then sent to any of the other network computers for execution. This means that one programming group can handle all network programming requirements, and that the same programs can be used throughout the network.

Downline program loading to satellites

The host computer can access programs from disc and transfer them to any other computer in the network, even though intervening computers in networks having more than two computer levels. Program loading can be initiated by the host, providing the capability for an entire memory fill in a satellite. Program loading can also be requested by satellites, enabling non-resident tasks to be initiated in satellites.

Scheduling of satellite tasks

The host can perform supervisory control of the entire network in centralized control systems. Programs can be accessed from disc and sent to satellites for execution based on time of day, elapsed time, system events, or based on analysis of the data received from the satellites.

Storage and processing of satellite data

The host computer in MAXNET systems usually contains more processing power, consisting of floating point hardware, more memory, and more peripherals. Therefore analysis, report generation and data file management functions can be performed efficiently at the host processor.

Sharing peripherals with satellites

The operation of most satellites can benefit by the capability to access programs and data from mass storage and by the use of high performance printers for report generation. With MAXNET, programs can be executed in satellites which assume the availability of local discs and printers, and MAXNET will relay these requests to the host for execution there.

Local processing

While controlling and servicing the satellites is normally the highest priority function of the host processor, most host processors also execute one or more background job streams. Each job stream is allocated a memory partition, usually 16K words in size, to enable FORTRAN compilations, assemblies and user program executions to be performed on a background basis. These background partitions can be checkpointed any time that foreground tasks require additional machine resources.

MAXNET satellite functions.

UNATTENDED SATELLITES

Local data acquisition
A program, written in either FORTRAN or assembly language, can be executed in each satellite to scan all local analog and digital channels and maintain a current value table in core memory.

Local process control
The local input data plus set point or other control parameters received from the host can be processed in the satellite to generate all local control parameters. This capability enables the satellite both to respond quickly to changes in input data and to maintain local control, even if the host or communications link fails.

Preprocessing of data to be sent to host
Functions such as the conversion of input data into engineering units and data filtering can be performed in the satellites to off load routine processing functions from the host processor.

Local scheduling of resident and non resident tasks
The satellites can schedule and control local tasks, whether resident or non resident, based on time of day, elapsed time, other tasks, interrupts, or local operator input. Local scheduling, when desirable, enables the host to perform more processing or to service more satellites. It also improves system reliability by making the satellites more independent.

Requesting and loading of non resident tasks from host
The local initiation of tasks can be handled as though a disc were available locally. The loading of non-resident tasks is handled transparent to the local task scheduler by means of the device assignment tables and link symbiont task.

ADDITIONAL ATTENDED SATELLITE FUNCTIONS

Local background processing using host stored processors and peripherals
A background job stream can be executed locally, accessing all compilers, assemblers, editors, etc. from the host disc and sending all listings and printed results to the host. This capability enables a satellite user to have all of the resources of a large computer system at a fraction of the cost.

Remote job entry to host
In even the smallest MAXNET satellites, the local operator can input compilation, assembly and execution jobs from the satellite console terminal for processing at the host computer.

Operator initiation of resident and non resident tasks in satellite
An experimenter, for example, can call for the downline loading of the program which controls his experiment simply by typing in directives from his console terminal. This program can be added to or replace existing programs, at the operator's discretion.

Operator initiation of tasks in other computers
The operator can initiate a task in any other computer connected to his satellite by typing in a simple directive from his local console terminal.

MAXNET system advantages.

Increased reliability
Since local satellites can operate, at least on a limited scale, independently of all other elements in the network the mean time to failure at each site is quite high. The network can also be configured for redundancy if required.

Easily installed and expanded
A network can be brought up by checking out local functions first and then checking the individual links. A new satellite can be added without disturbing the operation of existing satellites.

Choice of local or remote control
A network can have any combination of satellites which are controlled locally, entirely by the host or a combination of both. Remote processes, for example, can be controlled entirely by the central host. Satellites controlling experimental or pilot equipment, on the other hand, can be controlled by the local engineers and scientists, using the host only for additional computing resources.

Faster local response
Processing in satellites involves less communications time and often less task queuing time. Therefore, the response is usually faster than could be obtained from even a large central host processor.

System economy due to
Resource Sharing; Shorter Signal Cables; Use of Mini Computers Instead of a Large Mainframe.

Choice of MODCOMP computer to fit each site
A choice of MODCOMP II and MODCOMP IV computers is available to meet all satellite and host processor requirements. These program compatible computers range in size and capability from a small rack mountable "black box" to a large multicabinet unit having up to one-half million bytes of memory and high-performance 32-bit parallel processing capabilities.

Choice of Process and EDP Peripherals
MODCOMP offers analog and digital interface equipment capable of handling the signals from all common process equipment, experimental apparatus and instrumentation. EDP peripherals include a choice of fixed and moving head discs, magnetic tape drives, card and paper tape handling devices, printers and terminals. And all peripherals are supported by the MAXNET software operating system.

MAXNET software advantages.

Programs can be developed and executed in any network computer
Since all MODCOMP computers are upward program compatible and since MAXNET contains a logical I/O system in which logical files are linked to physical devices at run time, programs can be developed and debugged in one computer and then later executed in another computer. Since MAXNET can relay requests for peripheral devices through use of the device table and symbiont task, programs need not be changed when executed in different computer configurations.

Non-resident tasks can be executed in core-only computers
This capability enables even small satellites to perform a wide variety of functions without either local peripherals or local operator.

Flexible host — satellite relations
Any computer can initiate tasks, at a prearranged priority level, in any other computer to which it is connected. In addition, any computer can transfer information to or from any other computer. Therefore computer relationships are flexible. The host-satellite relationship is only the most common relationship used in MAXNET networks. Other relationships, including all computers operating at the same control level, are equally feasible.

User does not get involved in communications
The logical I/O system and symbiont link task enable the user to access all communications capabilities with FORTRAN READ and WRITE statements.

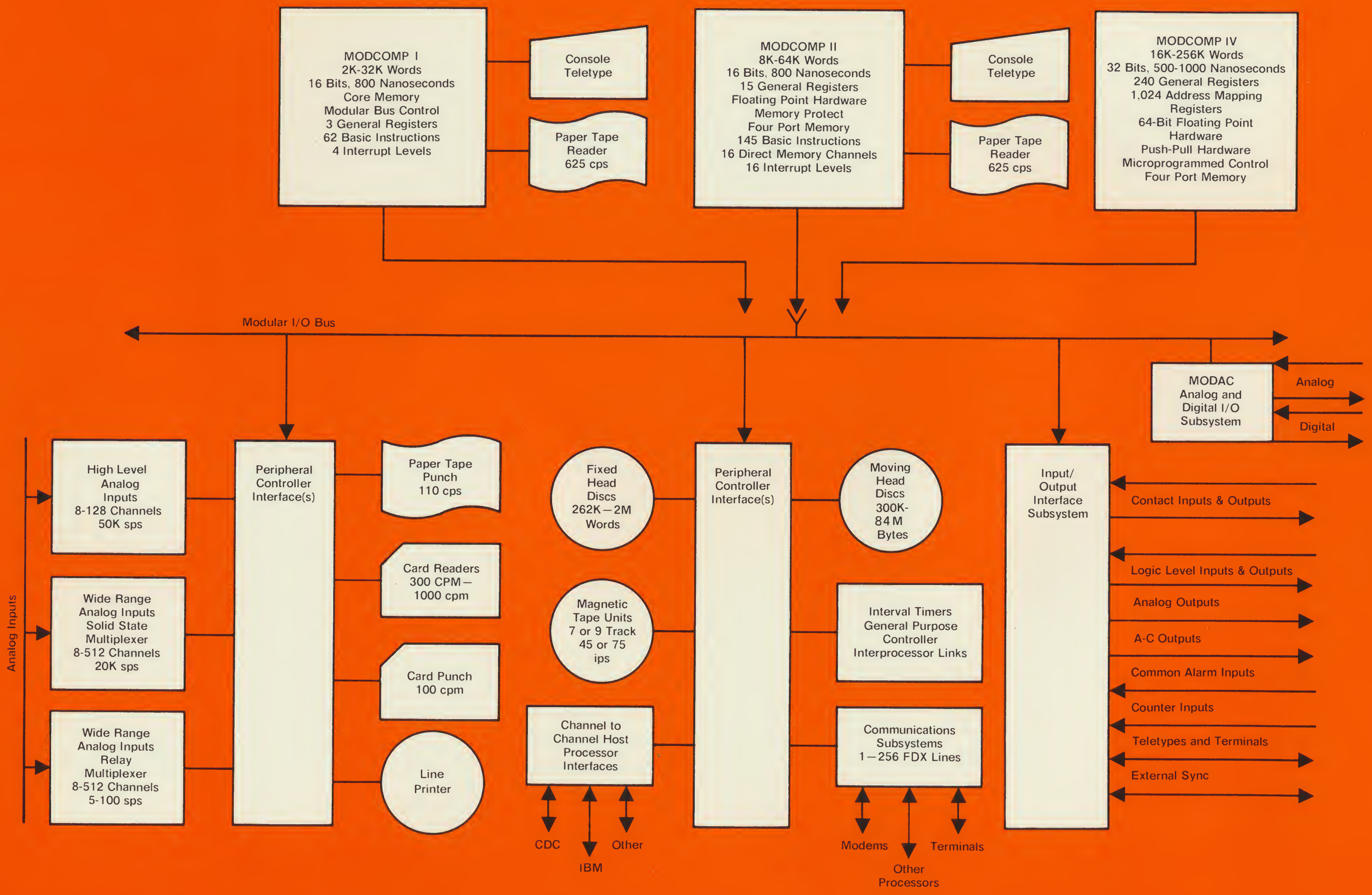
Direct inter-processor task communication
MAXNET offers the use of an optional core to core input/output devices which can be accessed through the logical I/O system either locally or remotely. Thus, tasks executing in remote processors any number of levels away from each other can communicate directly.

Device independent I/O locally and remotely
The logical I/O system makes the assignment of links and peripheral devices extremely flexible. For example, one computer can use a peripheral device by communicating through several levels of other computers.

Capability to modify device assignments
The device assignment table can be modified dynamically. Therefore if a failure occurs in one communications path or peripheral device, the assignment table can be modified to select an alternate one.

Sysgen procedure to tailor MAXNET for each computer
Only the handlers and executive services needed at each site need be included in the local MAXNET. Therefore core storage can be saved in the smaller configurations.

Compatible with all MODCOMP software
The wide range of software available with other MAX operating systems is also available with MAXNET, permitting the single computer user to upgrade to MAXNET if required and permitting the MAXNET user to take advantage of all existing MODCOMP software. The principal processors and packages include: FORTRAN IV, Macro Assembler, BASIC, Source Editor, File Manager, 2780 and 200UT Emulators, and Linear Programming.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16 Bits, 800 Nanoseconds
Core Memory
Modular Bus Control
3 General Registers
62 Basic Instructions
4 Interrupt Levels
Console Teletype
Paper Tape Reader 625 cps
MODCOMP II
8K-64K Words
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15 General Registers
Floating Point Hardware
Memory Protect
Four Port Memory
145 Basic Instructions
16 Direct Memory Channels
16 Interrupt Levels
Console Teletype
Paper Tape Reader 625 cps
MODCOMP IV
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32 Bits, 500-1000 Nanoseconds
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1,024 Address Mapping Registers
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Card Punch 100 cpm
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